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Title:	Summary of SSG-50 “Codes and Database” Meeting, and (n,f) Cross Section and Neutron Multiplicity Examples
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Los Alamos
NATIONAL LABORATORY

Summary of SSG-50 “Codes and Database” Meeting, and (n,f) Cross Section and Neutron Multiplicity Examples

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SSG-50 “Codes and Database” meeting of 4/6/2021

- Talk by V. Zerkin (IAEA) on the EXFOR relational database, X4Lite, accessing data in C5, XML, JSON as well as translation of data from EXFOR relational to JSON-EXFOR database,
- Discussion:
  - What type of database should be used: Relational or object-oriented?
  - Should we use JSON or XML like format?
  - What needs do users have? What types of data do we want to store?

Conclusion: we postponed the final decisions on the database until we have a few examples that can guide the decision process better.

Two examples of a SG-50 database entry are shown

- (n,f) cross section measured by an ionization chamber and as ratio to a reference reaction (^{235}U(n,f) cross section),
- Prompt fission neutron multiplicity (nu-bar) measured by the liquid-scintillator technique and as ratio to a reference observable (^{252}Cf(sf) nu-bar)

Comments:

- Many keys with values “missing”, “unknown”, etc. Need to highlight for layers 2 & 3 what missing information could cause concerns on data for evaluations.
- Need containers that give for a particular uncertainty source the uncertainty values, the correction values (if available), and units of all values,
- Need containers that allow for different representations of lattice.

Observable

	A	B	C	D
1	type	SIG		
2	incidentParticle	neutron		
3	incidentParticleEnergy	0.205	0.208	
4	incidentParticleFunction	energy		
5	incidentParticleUnit	MeV		
6	incidentParticleAngle	N/A		
7	incidentParticleResolution			
8	target	94-PU-239		
9	measuredParticle	FF		
10	measuredParticleFunction	energy		
11	reaction	(94-PU-239(N,F),,SIG)/(92-U-235(N,F),,SIG)		
12	residualNucleus	FF		
13	mtNumber	MF=3	MT=18	
14	absolute	yes		
15	ratioReference	92-U-235(N,F)		
16	polarizedBeam	Unknown		
17	observableMethod	TOF	FF Detection	Ratio Method
18	history	Compiled by S.H.	S.H. Updated sub 006 using corrected data from author (F.T.)	
19	analysisMethod	RatioFission		
20	comments	none		
21	critique	none		
22	status	table	author	
23	referenceFrame	lab		
24	results	1.033	1.069	
25	totalSystematic	N/A		
26	totalStatistical	0.9	0.9	
27	totalStatiUnit	%		
28	normalizationMethod	Ratiotothermal		
29	normalizationUnc	2		
30	normalizationUnit	%		

Bibliographic Information

	A	B	C
1	authors	F.Tovesson	T.S.Hill
2	institute	1USALAS	
3	reference	J,NSE,165,224,2010	
4	relevant references	N/A	
5	EXFOR entry #	14271	
6	Dataset entry #	14271003	
7	DOI	10.13182/NSE09-41	
8	related entries	14271006	

Incident Particles

	A	B	C
1	facility	LINAC	1USALAS
2	incidentSource	(SPALL)	
3	incidentReaction	(p,W)	
4	incidentSpectrum	LANSCE	
5	maxwellkT	N/A	
6	fluxValues	unknown	
7	currentValues	unknown	
8	beamEnergy	800 MeV	
9	beamPower		
10	energyCalibrationMethod	unknown	
11	pulseWidth	152 ps	
12	repRate	40 Hz	
13	fluxDeterminationMethod	unknown	
14	associatedParticleDetected	N/A	
15	beamStabilityMonitored	no	
16	acceleratorMonitored	yes	
17	secondaryParticleMonitored	N/A	
18	secondaryParticleGroups	none	
19	numberTargetAtoms	unknown	
20	targetStability	unknown	
21	fluxMonitored	unknown	
22	beamDiameter	unknown	
23	beamUniformityCorrected	yes	
24	beamUniformityCorrection	unknown	
25	flightPathLength	10.882 m	
26	zeroTimeOffset	1.6 ns	
27	gasCellPressure	unknown	
28	gasCellTemperature	unknown	
29	gasTemperatureCorrected	N/A	
30	gasTemperatureCorrection	N/A	
31	gasCellEffectsCorrected	N/A	
32	gasCellEffectsCorrection	N/A	
33	Method	TOF	
34	TOF length unc.	0.002 m	

Background Types

	A	B	C	D
1	type	235U	239Pu	
2	corrected	yes	yes	
3	correctionMethod	Measured, Fit	Measured, Fit	
4	energyDependent	yes		
5	backgroundValue	unknown		
6	backgroundUnc1	3.1	2.9	…
7	backgroundUnc2	3.1	3.1	…
8	backgroundUncUnit	%		

Detectors

	A	B	C
1	type	IOCH	
2	manufacturer	Unknown	
3	use	Reaction	
4	daqSystem	Unknown	
5	detectorNumber	1	
6	detectorVolume	Unknown	
7	detectorRadius	Unknown	
8	detectorThickness	unknown	
9	detectorGas	90% argon	10% methane
10	detectorPressure	164 kPA	
11	detectorMaterial	unknown	
12	detectorReaction	FF	
13	efficiencyMethod	ratio	
14	calbirationSources	unknown	
15	efficiencyValues	N/A	
16	pulseHeightExtrapCorrected	yes	
17	pulseHeightExtrapCorrection	yes	
18	detectorShielding		
19	angularCoverage	N/A	
20	solidAngle	N/A	
21	stoppingPowerCorrected	no	
22	stoppingPowerCorrection	N/A	
23	forwardBoostCorrected	no	
24	forwardBoostCorrection	N/A	
25	angularDistortionCorrected	no	
26	angularDistortionCorrection	N/A	
27	deadTimeCorrected	yes	
28	deadTimeCorrection	Unknown	
29	detectorLiveTime	N/A	
30	discriminatorCorrected	N/A	
31	discriminatorCorrection	N/A	
32	sumPeaksCorrected	N/A	
33	sumPeaksCorrection	N/A	
34	gammaAngularDistCorrected	N/A	
35	gammaAngularDistCorrection	N/A	
36	countingGeomCorrected	N/A	
37	countyingGeomCorrection	N/A	
38	delayedGammasCorrected	N/A	
39	delayedGammasCorrection	N/A	
40	falseFissionCorrected	N/A	
41	falseFissionCorrection	N/A	
42	sampleRadioactivityCorrected	N/A	
43	pulsePileupCorrection	yes	
44	electronicNoiseCorrected	N/A	

Detectors

	A	B	C
45	electronicNoiseCorrection	N/A	
46	frenchEffectCorrected	N/A	
47	frenchEffectCorrection	N/A	
48	hsContentCorrected	N/A	
49	hsContentCorrection	N/A	
50	manganeseCaptureCorrected	N/A	
51	manganeseCaptureCorrection	N/A	
52	spectrumUnfolded	N/A	
53	spectrumUnfolding	N/A	
54	timeGateOpen	N/A	

Samples

	A	B	C	D	E	F
1	sampleMaterial	239Pu		242Pu		235U
2	use	Reaction		Background		Monitor
3	incidentEnergy	Is this not double-counting?				
4	sampleConfiguration	Parallel plate				
5	enrichment	240Pu	241Pu			
6	impuritiesCorrected	y				
7	impuritiesCorrection	0.135 mg	0.001 mg			
8	ImpuritiesUncertainties	unknown				
9	sampleType	Metal foil				
10	sampleProduction					
11	sampleThickness	"thin"				
12	sampleMass	15.05 mg	Unc: 0.1 mg	9.912 mg	Unc: 0.007 m	Unknown
13	sampleRadius	5 cm				
14	sampleHeight	N/A				
15	sampleWidth	N/A				
16	sampleArealDensity	200 mu-g/cm2				
17	sampleMassDensity	N/A				
18	sampleNumberDensity	N/A				
19	sampleDensityMethod	N/A				
20	particulatesRadius	N/A				
21	sampleUniformityCorrected	Yes				
22	sampleUniformityCorrection	unknown				
23	backingMaterial	titanium				
24	backingThickness	0.004 mm				
25	containmentMaterial	N/A				
26	containmentThickness	N/A				
27	sampleRoughnessCorrected	Yes				
28	sampleRoughnessCorrection	unknown				
29	numberSamples	6				
30	sampleDisplacementCorrect	N/A				
31	sampleDisplacementCorrect	N/A				
32	samplePosition	??				
33	thermodynamicTemperature	N/A				
34	effectiveTemperature	N/A				
35	beamOverlapCorrected	no				
36	beamOverlapCorrection	unknown				
37	beamFluctuationCorrected	no				
38	beamFluctuationCorrection	unknown				
39	selfShieldingCorrected	N/A				
40	selfShieldingCorrection	N/A				
41	multipleSampledCorrected	Yes				
42	multipleSampledCorrection	Unknown				
43	pulsePileupCorrected	Yes				
44	irradiationTime	N/A				

Samples

	A	B	C	D	E	F
45	coolingTime	N/A				
46	countingTime	N/A				

Samples

	G	H	I	J
1		238U		
2		Monitor accelerator off-time current		
3				
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12	Unc.: unknow	Unknown	Unknonwn	
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44				

Samples

	G	H	I	J
45				
46				

Multiple Scattering

	A	B
1	multipleScatteringCorrected	no
2	multipleScatteringCorrection	N/A
3	partsIncluded	N/A
4	correctionMethod	N/A
5	codeUsed	N/A
6	componentsIncluded	N/A
7	maxScatters	N/A
8	nuclearData	ENDF/B-VII.0
9	attenuationCorrected	yes
10	attenuationCorrection	unknown
11	partsIncluded	unknown
12	correctionMethod	Monte Carlo
13	codeUsed	MCNP
14	componentsIncluded	unknown
15	maxScatters	unknown
16	ParticleScattered	neutrons
17	ParticleAttenuated	neutron

Resolution Function

	A	B
1	type	N/A
2	equation	N/A
3	parameter values	N/A
4	codeUsed	N/A
5	codeInput	N/A

Reference Data

	A	B
1	type	N/A
2	reaction	N/A
3	value	N/A
4	reference	N/A
5	decayParent	N/A
6	particleDetected	N/A
7	MaxwellValue	N/A
8	wattValue	N/A

Other Corrections

	A	B
1	type	N/A
2	correctionMethod	N/A
3	correctionValue	N/A
4	reference	N/A

Observable

	A	B	C	D
1	type	PR,NU,,AV		
2	incidentParticle	neutron		
3	incidentParticleFunction	energy		
4	incidentParticleEnergy	Given as bins		
5	incidentParticleAngle	N/A		
6	incidentParticleResultion			
7	target	94-PU-239		
8	measuredParticle	FF	neutron	gammas
9	measuredParticleFunction	energy		
10	reaction	(94-PU-239(N,F),PR,NU,,AV)/(98-CF-252(0,F),PR,NU,,AV)		
11	residualNucleus	N/A		
12	mtNumber	MF=1	MT=456	
13	absolute	yes		
14	ratioReference	98-CF-252(0,F),PR,NU,,AV		
15	polarizedBeam	Unknown		
16	observableMethod	(TOF)	Liquid scintillator measurement	Ratio method
17	history	870520C		
18	analysisMethod	Ratio method		
19	comments	none		
20	critique	none		
21	status	approved by author		
22	referenceFrame	lab		
23	results	0.758	0.793	...
24	totalSystematic	N/A		
25	totalStatistical	2.77044855	3.90920555	...
26	totalStatiUnit	%		
27	incidentParticleEnergy-min	5.00E-04	6.00E-04	...
28	incidentParticleEnergy-max	6.00E-04	7.00E-04	...

Bibliographic Information

	A	B	C	D
1	authors	R.GWIN	R.R.SPENCER	R.W.INGLE
2	institute	1USAORL		
3	reference	J,NSE,94,365,8612		
4	relevant references	N/A		
5	EXFOR entry #	13101		
6	Dataset entry #	13101004		
7	DOI	10.1016/0029-5493(86)90019-1		
8	related entries	12833004	12906002	

Incident Particles

	A	B	C
1	facility	(LINAC)	(1USAORL)
2	incidentSource	ORELA	
3	incidentReaction	ORELA	
4	incidentSpectrum	ORELA	
5	maxwellkT	N/A	
6	fluxValues	unknown	
7	currentValues	unknown	
8	beamEnergy	ORELA	
9	beamPower	ORELA	
10	energyCalibrationMethod	Unknown	
11	pulseWidth	unknown	
12	repRate	unknown	
13	fluxDeterminationMethod	unknown	
14	associatedParticleDetected	N/A	
15	beamStabilityMonitored	yes	
16	acceleratorMonitored	yes	
17	secondaryParticleMonitored	unknown	
18	secondaryParticleGroups	unknown	
19	numberTargetAtoms	N/A	
20	targetStability	unknown	
21	fluxMonitored	yes	
22	beamDiameter	unknown	
23	beamUniformityCorrected	unknown	
24	beamUniformityCorrection	unknown	
25	flightPathLength	83.4 m	
26	zeroTimeOffset	unknown	
27	gasCellPressure	unknown	
28	gasCellTemperature	unknown	
29	gasTemperatureCorrected	N/A	
30	gasTemperatureCorrection	N/A	
31	gasCellEffectsCorrected	N/A	
32	gasCellEffectsCorrection	N/A	

Background Types

	A	B
1	type	in Neutron Detector
2	corrected	yes
3	correctionMethod	Measured
4	energyDependent	yes
5	backgroundValue	unknown
6	backgroundUnc	Part of stat. unc.

Detectors

	A	B	C	D
1	type	(SCIN)	(FISCH)	(IOCH)
2	manufacturer	Unknown	Unknown	unknown
3	use	Reaction (N)	Reaction (FF)	Flux Monitor
4	daqSystem	Unknown	Unknown	unknown
5	detectorNumber	1	1	1
6	detectorVolume	0.91 m^3	Unknown	unknown
7	detectorRadius	0.6 m	13.9 cm	unknown
8	detectorThickness	0.6 m	Unknown	unknown
9	detectorGas	Gd	Unknown	BF3
10	detectorPressure	Unknown	Unknown	unknown
11	detectorMaterial	Gd	Unknown	BF3
12	detectorReaction	N-capture	FF	(n,BF3)
13	efficiencyMethod	Measured	Unknown	unknown
14	calbirationSources	Unknown	Unknown	unknown
15	efficiencyValues	Unknown	Unknown	unknown
16	pulseHeightExtrapCorrected	N/A	N/A	N/A
17	pulseHeightExtrapCorrection	N/A	N/A	N/A
18	detectorShielding	Unknown	Unknown	unknown
19	angularCoverage	nearly 180deg	1 angle	1 angle
20	solidAngle	N/A	Unknown	unknown
21	stoppingPowerCorrected	N/A	yes	N/A
22	stoppingPowerCorrection	N/A	Unknown	N/A
23	forwardBoostCorrected	no	no	no
24	forwardBoostCorrection	N/A	N/A	N/A
25	angularDistortionCorrected	no	no	no
26	angularDistortionCorrection	N/A	N/A	N/A
27	deadTimeCorrected	yes	yes	yes
28	deadTimeCorrection	Unknown	Unknown	unknown
29	detectorLiveTime	N/A	N/A	N/A
30	discriminatorCorrected	N/A	N/A	N/A
31	discriminatorCorrection	N/A	N/A	N/A
32	sumPeaksCorrected	N/A	N/A	N/A
33	sumPeaksCorrection	N/A	N/A	N/A
34	gammaAngularDistCorrected	N/A	N/A	N/A
35	gammaAngularDistCorrectio	N/A	N/A	N/A
36	countingGeomCorrected	N/A	N/A	N/A
37	countingGeomCorrection	N/A	N/A	N/A
38	delayedGammasCorrected	Yes	N/A	N/A
39	delayedGammasCorrection	Unknown	N/A	N/A
40	falseFissionCorrected	Yes	Yes	N/A
41	falseFissionCorrection	Unknown	Unknown	N/A
42	sampleRadioactivityCorrecte	yes	yes	N/A
43	pulsePileupCorrection	Yes	yes	Yes
44	electronicNoiseCorrected	N/A	N/A	N/A

Detectors

	A	B	C	D
45	electronicNoiseCorrection	N/A	N/A	N/A
46	frenchEffectCorrected	N/A	N/A	N/A
47	frenchEffectCorrection	N/A	N/A	N/A
48	hsContentCorrected	N/A	N/A	N/A
49	hsContentCorrection	N/A	N/A	N/A
50	manganeseCaptureCorrected	N/A	N/A	N/A
51	manganeseCaptureCorrectio	N/A	N/A	N/A
52	spectrumUnfolded	N/A	N/A	N/A
53	spectrumUnfolding	N/A	N/A	N/A
54	timeGateOpen	31.5 mus		
55	throughTubeDiameter	13.9 cm		

Samples

	A	B	C	D
1	sampleMaterial	239Pu		252Cf
2	use	Reaction		Monitor
3	incidentEnergy	Is this not double-counting		
4	sampleConfiguration	Sample replacement		
5	enrichment	240Pu	241Pu	unknown
6	impuritiesCorrected	y		unknown
7	impuritiesCorrection	0.02%	0.00%	unknown
8	sampleType	Metal foil		
9	sampleProduction			
10	sampleThickness	"thin"		
11	sampleMass	unknown		
12	sampleRadius	unknown		
13	sampleHeight	N/A		
14	sampleWidth	N/A		
15	sampleArealDensity	0.9 g/m^2		
16	sampleMassDensity	N/A		
17	sampleNumberDensity	N/A		
18	sampleDensityMethod	N/A		
19	particulatesRadius	N/A		
20	sampleUniformityCorrected	yes		
21	sampleUniformityCorrection	unknown		
22	backingMaterial	aluminum		
23	backingThickness	0.0013 cm		
24	containmentMaterial	N/A		
25	containmentThickness	N/A		
26	sampleRoughnessCorrected	yes		
27	sampleRoughnessCorrection	unknown		
28	numberSamples	1		1
29	sampleDisplacementCorrected	yes		
30	sampleDisplacementCorrection	unknown		
31	samplePosition	??		
32	thermodynamicTemperature	N/A		
33	effectiveTemperature	N/A		
34	beamOverlapCorrected	N/A		
35	beamOverlapCorrection	N/A		
36	beamFluctuationCorrected	yes		
37	beamFluctuationCorrection	unknown		
38	selfShieldingCorrected	N/A		
39	selfShieldingCorrection	N/A		
40	multipleSampledCorrected	yes (SampleDisplacement)		
41	multipleSampledCorrection	unknown		
42	pulsePileupCorrected	yes		
43	irradiationTime	N/A		
44	coolingTime	N/A		

Samples

	A	B	C	D
45	countingTime	N/A		

Multiple Scattering

	A	B
1	multipleScatteringCorrected	yes
2	multipleScatteringCorrection	unknown
3	partsIncluded	all
4	correctionMethod	Measured
5	codeUsed	N/A
6	componentsIncluded	all
7	maxScatters	Measured
8	nuclearData	N/A

Resolution Function

	A	B
1	type	N/A
2	equation	N/A
3	parameter va	N/A
4	codeUsed	N/A
5	codeInput	N/A

Reference Data

	A	B
1	type	N/A
2	reaction	N/A
3	value	N/A
4	reference	N/A
5	decayParent	N/A
6	particleDetected	N/A
7	MaxwellValue	N/A
8	wattValue	N/A

Other Corrections

	A	B
1	type	N/A
2	correctionMethod	N/A
3	correctionValue	N/A
4	reference	N/A

Correlations to Other Dataset

	A	B	C
1	entry	12906	12833
2	correlatingFactor	Sample	Sample
3	correlationShape	Full	Full
4	correlationValues	1	1